Update to Hot Soak Emission Estimates

(M6.EVP.004)

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What are “hot soak” emissions?

- Emissions occurring at end of trips
- Fuel system / engine heated well above ambient
- Emissions result until vehicular temperatures drop to ambient temperature

MOBILE5 Hot Soak emission rates

- Based on laboratory testing, one-hour soaks
- Typically at 82°F, 9.0 psi RVP fuel, 40% tank fill
- Corrections made for other temperatures, RVP levels

Newer data considered

- Auto/Oil program (1993): Almost 300 LDVs and LDTs, MY 1983-93
- EPA testing: Almost 200 LDVs and LDTs, MY 1981-94
- Above testing at Mesa AZ (recruited from I/M lanes)
- All tested "as received" (in-use fuel, uncontrolled tank fill levels)

Newer data considered

- Also included limited data from earlier EPA contract testing
- Those WAs added another 133 vehicles to the data used in this analysis

Plan: Update hot soak for lower volatility fuels

- In today's climate, hot soak (& other evap emissions) of interest mostly in summer (ozone) season
- Volatility controls in place over summer nationally
- "Newer data" covers RVP range of 5.7-9.0 psi

Stratifications of data

- Gross liquid leakers (category not defined or used in MOBILE5)
- “High” (> 2.0 g / test) and “normal” emitters
- Status on purge / pressure tests of evaporative control system
- Fuel system (carbureted, fuel-injected)
- Split at 1986 MY

Gross Liquid Leakers

- New stratification in MOBILE6
- Addressed in all evaporative emissions analyses
- Definitions still to be reconciled
- In this analysis, any vehicle with hot soak emissions > 10 grams/test were separated and considered as liquid leakers

Gross Liquid Leakers

- Separated only by fuel delivery systems (carbureted vs fuel-injected)
- Characterized only by average emission level
- 14.6 g / test for carbureted vehicles, 57.8 g / test for fuel-injected vehicles

Treatment of data

- Adjust all data to 95°F using MOBILE5 temperature corrections
- Regressions against fuel volatility (RVP) level
- Additional adjustments

MOBILE5 Hot Soak Emissions

- MOBILE5 uses distinct correction factors for RVPs above / below 9.0 psi
- This analysis only reexamined hot soak emissions for RVP < 9.0
- Choice made to “fix” hot soak as fct(temp) to meet MOBILE5 estimates at 9.0 psi RVP.

Results

- New correction equations developed for various strata, for RVP < 9.0 psi
- Data not adequate to support all planned stratifications
- Summary of cases for which new equations were developed follows
- HS = exp[a*(RVP-9.0) + b*(T-82.0) +c]

“Fail Pressure Test” or “Fail Purge Test”

- Within three fuel delivery system stratifications (carbureted, throttle body fuel injected, port fuel injected, equations developed for “high” and “normal” emitters

Pass Both Purge and Pressure tests

- High emitters: Equations for fuel-injected and for carbureted
- Normal emitters: Equations for TBI, PFI and carbureted
  - for TBI and PFI: LDVs further divided as MY1981-85 and MY1986+
  - for carbureted: both LDVs and LDTs divided into MY 1981-85 and 1986+

Results

- In the range for which the new equations were intended (RVP<9.0), previous curves (MOBILE5) lie between “high emitter” and “normal emitter”curves
- Differences in terms of absolute change in emissions tended to be very slight

Comments Received

- Substantive and detailed comments received over last two weeks from American Petroleum Institute and from Air Improvement Resources
- API comments included detailed alternative approach to analysis
- Major issues raised by both comments

Issues raised by comments

- Assumption that MOBILE hot soak estimates are “right” at 9.0 psi RVP
- Use of “dummy” data points generated by MOBILE5 equations
- Weighting of multiple tests from single vehicle at varied conditions

Issues raised by comments

- How proportion of fleet in each pressure / purge status category not addressed
- How effects of enhanced evap test procedure will be included not addressed
- How hot soak for heavier vehicles (LDGT2s and HDGEs) not addressed